Proposed Amendments to the Grade 8 Science Standards

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Selection	**Action (Labels given are from new articulation)**
8.1. Broad Concept: Scientific progress is made by asking relevant questions and conducting careful investigations. As a basis for understanding this concept, and to address the content in this grade, students should develop their own questions and perform investigations.	**Moved to preamble paragraph 2**
8.1. 1. Describe how scientific knowledge is subject to modification and refinement as new information challenges prevailing theories	**8.1.1**
8.1. 2. Test hypotheses that pertain to the content under study.	**8.1.2**
8.1. 3. Describe how if more than one variable changes at the same time in an experiment, the outcome of the experiment may not be attributable to a change in any single variable.	**8.2.1**
8.1. 4. Explain why accuracy and openness in record keeping and replication are essential for maintaining an investigator's credibility with other scientists and society.	**Moved to preamble paragraph 3**
8.1. 5. Write clear step-by-step instructions (procedural summaries) for conducting investigations.	**8.2.2**
8.1. 6. Participate in group discussions on scientific topics by restating or summarizing accurately what others have said, asking for clarification or elaboration, and expressing alternative positions.	**"Participate…" moved to preamble paragraph 3, "Restate and summarize" to 8.1.3**
8.1. 7. Use tables, charts, and graphs in making arguments and claims in presentations about lab work.	**8.2.3**
8.1. 8. Read analog and digital meters on instruments used to make direct measurements of length, volume, weight, elapsed time, rates, or temperatures, and choose appropriate units. Explain how to interpolate on analog scales.	**8.2.4**
8.1. 9. Explain why arguments may be invalid if based on very small samples of data, biased samples, or experiments in which there was no control sample.	**8.2.5**
8.1. 10. Identify and criticize the reasoning in arguments in which fact and opinion are intermingled or the conclusions do not follow logically from the evidence given, an analogy is not apt, no mention is made of whether the control group is very much like the experimental group, or all members of a group are implied to have nearly identical characteristics that differ from those of other groups.	**8.1.4**
8.1. 11. Describe the work of pioneers of physics and cosmology, such as Nicolaus Copernicus,	**Moved to preamble "Exposed to- a"**

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Galileo Galilei, Johannes Kepler, Isaac Newton, Hans Christian Oersted and Andre-Marie Ampère, Dmitry Ivanovich Mendeleyev, Albert Einstein, and Lise Meitner.	
8.1. 12. Apply simple mathematical models to problems (e.g., formulas such as *F* = *ma*).	**8.11.5**
8.2. Broad Concept: Elements have distinct macroscopic properties and atomic structures.	**Embedded in Standard 3: Structure of Matter**
8.2. 1. Explain that all matter is made up of atoms that are far too small to see directly through an optical microscope.	**8.3.1**
8.2. 2. Construct a model of an atom and know the atom is composed of protons, neutrons, and electrons.	**8.3.2**
8.2. 3. Using a periodic chart, explain that the atoms of any element are similar to each other, but they are different from atoms of other elements. Know that the atoms of a given isotope are identical to each other.	**8.4.1**
8.2. 4. Diagram and describe how atoms may combine (bond) into molecules or into large crystalline arrays.	**8.5.1**
8.2. 5. Know that there are more than 100 elements that combine in a multitude of ways to produce compounds that make up all the living and nonliving things in the universe.	**8.5.2**
8.2. 6. Describe how elements can be classified, based on similar properties, into categories, including highly reactive metals, less reactive metals, highly reactive nonmetals, less reactive nonmetals, and some almost completely non-reactive (noble) gases.	**8.4.2**
8.2. 7. Understand how an ion is an atom or group of atoms (molecule) that has acquired an electric charge by losing or gaining one or more electrons.	**8.5.3**
8.2. 8. Describe how the atoms, molecules, or ions comprising an object are in constant individual motion, and explain how their average motional (kinetic) energy determines the temperature of the object, and how the strength of the forces between them determines the state of matter at that temperature.	**8.6.1**
8.2. 9. Explain that the melting and boiling temperatures of a substance (element or compound) depend on pressure and are independent of the amount of the sample. (Some materials do not melt and others do not boil because they decompose as the temperature is raised; other materials do not have a sharp melting point because they are not homogeneous.)	**8.6.2**
8.2. 10. Describe the contributions of the scientists involved with the development of current atomic theory, including John Dalton, Marie and Pierre Curie, Joseph John Thomson, Albert Einstein, Max Planck, Ernest Rutherford, Niels Bohr, and Erwin Schroedinger.	**Moved to preamble "Exposed to – b"**
8.3. Broad Concept: Chemical reactions are processes in which atoms are rearranged into different combinations of molecules.	**Embedded ins Standard 8: Chemical Reactions**

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8.3. 1. Discover and explain how elements and compounds (reactants) react with each other to form products with different properties.	**"Discover…" moved to preamble "Discover – a", "Explain" to 8.8.1**
8.3. 2. Describe Antoine Lavoisier's work, including the idea that when materials react with each other, many changes can take place, but that in every case the total amount of matter afterward is the same as before (Law of Conservation of Matter).	**Name moved to preamble "Exposed to – b", Law to 8.7.1**
8.3. 3. Explain how the idea of atoms, as proposed by John Dalton, explains the conservation of matter: In chemical reactions, the number of atoms stays the same no matter how they are arranged, and the mass of atoms does not change significantly in chemical reactions, so their total mass stays the same.	**Name moved to preamble "Exposed to – b", Application to 8.7.2**
8.3. 4. Investigate and explain how during endothermic chemical reactions heat energy is absorbed from the surroundings, and in exothermic reactions heat energy is released to the surroundings.	**"Investigate…" moved to preamble "Investigate – a", "Explain" to 8.8.2**
8.3. 5. Investigate and explain that reactions occur at different rates, slow to fast, and that reaction rates can be changed by changing the concentration of reactants, the temperature, the surface areas of solids, and by using a catalyst.	**"Investigate…" moved to preamble "Investigate – b", "Explain" to 8.8.3**
8.3. 6. Recognize that solutions can be acidic, basic, or neutral, depending on the concentration of hydrogen ions in the solution. Understand that because this concentration can vary over a very large range, the logarithmic pH scale is used to describe how acidic or basic a solution is (each increase of one in the pH scale is an increase of 10 times in concentration).	**8.8.4**
8.3. 7. Recognize that indicators of chemical changes include temperature change, the production of a gas, the production of a precipitate, or a color change.	**8.8.5**
8.4. Broad Concept: All objects experience a buoyant force when immersed in a fluid.	**Embedded in standard 10: Special Forces**
8.4.1. Demonstrate that the mass of an object is a measure of the quantity of matter it contains (measured in kg or g), and that its weight (measured in N) is the magnitude of the gravitational force exerted between Earth and that much mass.	**8.10.2**
8.4.2. Know that density is mass per unit volume.	**8.3.4**
8.4.3. Investigate and explain that equal volumes of different substances usually have different masses and, therefore, different densities.	**"Investigate…" moved to preamble "Investigate – c", "Explain" to 8.3.5**
8.4.4. Determine and explain that the buoyant force on an object in a fluid is an upward force equal to the weight of the fluid the object has displaced; this principle can be used to predict whether an object will float or sink in a given fluid.	**8.10.3**
8.4.5. Determine the density of substances (regular and irregular solids, and liquids) from direct measurements of mass and volume, or of volume by water displacement.	**8.3.6**
8.5. Broad Concept: Energy and matter have multiple forms and can be changed from one form	**Embedded in Standard 12: Forms of Energy**

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to another.	
8.5. 1. Explain how energy is the ability to do work and is measured in joules (J).	**8.12.1**
8.5. 2. Describe kinetic energy as the energy of motion (e.g., a rolling ball), and potential energy as the energy of position or configuration (e.g., a raised object or a compressed spring).	**8.12.2**
8.5. 3. Investigate and explain how kinetic energy can be transformed into potential energy, and vice versa (e.g., in a bouncing ball).	**8.15.1**
8.5. 4. Recognize and describe that energy is a property of many systems and can take the forms of mechanical motion, gravitational energy, the energy of electrostatic and magnetostatic fields, sound, heat, and light (electromagnetic field energy).	**8.12.3**
8.5. 5. Describe that energy may be stored as potential energy in many ways, including chemical bonds and in the nucleus of atoms.	**8.12.4**
8.5. 6. Explain that the sun emits energy in the form of light and other radiation, and only a tiny fraction of that energy is intercepted by the Earth.	**8.12.5**
8.5. 7. Know that the sun's radiation consists of a wide range of wavelengths, mainly visible light, infrared, and ultraviolet radiation.	**8.12.6**
8.5. 8. Investigate and explain that heat energy is a common product of an energy transformation, such as in biological growth, the operation of machines, the operation of a light bulb, and the motion of people.	**"Investigate…" moved to preamble "Investigate", "Explain" to 8.15.2**
8.5. 9. Explain how electrical energy can be generated using a variety of energy sources and can be transformed into almost any other form of energy, such as mechanical motion, light, sound, or heat.	**8.15.3**
8.5. 10. Investigate and explain that in processes at the scale of atomic size or greater, energy cannot be created or destroyed but only changed from one form into another.	**"Investigate…" moved to preamble "Investigate – f", "Explain" to 8.16.1**
8.5. 11. Compare and contrast how heat energy can be transferred through radiation, convection, or conduction.	**8.15.4**
8.6. Broad Concept: Electricity and magnetism are related phenomena that have many useful applications in everyday life.	**Embedded in Standard 9: Electricity and Magnetism**
8.6. 1. Investigate and explain that an object can be electrically charged either positively or negatively; objects with like charges repel each other, and objects with unlike charges attract each other.	**"Investigate…" moved to preamble "Investigate – g", "Explain" to 8.3.3**
8.6. 2. Explain that when an electric current flows why there is always a magnetic field associated with it.	**8.9.1**
8.6. 3. Describe the role that electromagnets play in electric motors, electric generators, and simple devices such as doorbells and earphones.	**8.9.2**

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8.6. 4. Explain how electrical circuits provide a means of transferring electrical energy from sources such as generators to devices in which heat, light, sound, and chemical changes are produced.	**8.9.3**
8.6. 5. Know that power is energy per unit of time, expressed in watts, W, and 1 W = 1 J/s. Explain that devices are rated according to their power capacity or consumption.	**8.15.5**
8.7. Broad Concept: When an object is subject to two or more forces at once, the effective force is the cumulative effect of all the forces.	**Embedded in Standard 11: Forces and Motion**
8.7. 1. Recognize that a force has both magnitude and direction.	**8.11.1**
8.7. 2. Observe and explain that when the forces on an object are balanced (equal and opposite forces that add up to zero), the motion of the object does not change.	**8.11.2**
8.7. 3. Explain why an unbalanced force acting on an object changes the object's speed or direction of motion or both.	**8.11.3**
8.7. 4. Explain that every object exerts an attractive gravitational force on every other object.	**8.10.1**
8.7. 5. Know that the greater the mass of an object, the more force is needed to change its motion.	**8.11.4**
8.7. 6. Explain that if the net force acting on an object always acts toward the same center as the object moves, the object's path is a curve about the force center. (Motion in a circular orbit is the simplest example of this concept.)	**8.11.6**
8.7. 7. Plot and interpret distance versus time graphs for constant speed.	**8.11.7**
8.8. Broad Concept: Waves have characteristic properties that are common to all types of wave.	**Embedded in Standard 14: Wave Properties**
8.8. 1. Observe and explain how waves carry energy from one place to another.	**8.14.1**
8.8. 2. Explain how a mechanical wave is a disturbance that propagates through a medium.	**8.13.1**
8.8. 3. Explain how electromagnetic waves differ from mechanical waves in that they do not need a medium for propagation; nevertheless, they can be described by many of the same quantities: amplitude, wavelength, frequency (or period), and wave speed.	**8.13.2**
8.8. 4. Investigate and explain how sound in a fluid (e.g., air) is a longitudinal wave whose speed depends on the properties of the fluid in which it propagates.	**"Investigate…" moved to preamble "Investigate – h", "Explain" to 8.14.2**
8.8. 5. Investigate and explain how light waves, sound waves, and other waves move at different speeds in different materials.	**"Investigate…" moved to preamble "Investigate – i", "Explain" to 8.14.3**
8.8. 6. Demonstrate that vibrations in materials set up wave disturbances, such as sound and earthquake waves, which spread away from the source.	**8.14.4**
8.8. 7. Recognize that human eyes respond to a narrow range of wavelengths of the electromagnetic spectrum (red through violet) called *visible light*	**8.13.3**
8.8. 8. Summarize how something can be "seen" when light waves emitted or reflected by an	**8.13.4**

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object enter the eye, just as something can be “heard” when sound waves from an object enter the ear.	
8.8. 9. Explain that waves obey the superposition principle: Many waves can pass through the same point at once, and the wave amplitude at that point is the sum of the amplitudes of the individual waves.	**8.14.5**

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